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AUTHOR Truxal, John G.
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ABSTRACT

Studies offered by the Department of Technology and Society at the State University of New York at Stony Brook are described. The program of studies for nonengineering students provides an introduction to the characteristics, capabilities, and limitations of the technological environment. The college provides courses for undergraduates in the liberal arts, and in the early 1970s focused on issues such as energy, water, and privacy implications of computers. More recently, courses have been offered in communications, space programs, weather modification, and problem-solving techniques. The engineering approach, rather than an interdisciplinary approach, is followed. The program offers four courses designed for undergraduate engineering students: freshman engineering, biomedical engineering, engineering and managerial economics, and communication skills in engineering and applied science. An attempt is made to develop student awareness of the social dimensions of engineering. The college offers a number of graduate courses designed for the nonengineering students and a master's degree (in applied science) for students seeking a total program in modern technology and engineering techniques of problem formulation and analysis. Additionally technology courses for graduate students in public administration, offerings on educational uses of computers, and graduate television courses have been sponsored. The college has developed secondary school educational materials on modern technology and has offered a college course for gifted high school juniors and seniors. In addition, the college has developed materials on technology designed for the general public. Information on faculty, teaching activities, and grant support is included. (SW)

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TECHNOLOGY EDUCATION FOR ALL

(Role of the Department of Technology and Society at Stony Brook)

The Engineering College of the State University of New York at Stony Brook has developed one of the most successful programs of courses for non-engineering students -- courses designed to introduce the students to the characteristics, capabilities, and limitations of the technological environment in which they will work and live. By the 1979-80 academic year, this program attracted about 75% of liberal arts undergraduates to at least one engineering course (in addition to the conventional College offerings in computer science, operations research, and statistics).

The objectives of the program are graduates better able to understand modern technology and to participate intelligently in public decisions on technological issues. The success of the Stony Brook program depends on recognition within the College of the importance of this academic activity in relation to the broad missions of the State University and this campus, and on the continuing modification of the program to match the interests and academic goals of the students.

The full college program in technological literacy addresses a wide range of audiences, much broader than merely the liberal arts undergraduate, because of the urgency of the issues facing the nation today. While specific activities are often useful with several audiences, it is convenient to think in terms of five primary groups.

I. Undergraduate Liberal Arts Students

The College has developed a set of courses over the last eight years. In accord with student interests, the courses originated in the early 1970's focus on major socio-technological issues such as energy, water, and privacy implications of computers. Here the thrust is to determine the nature and magnitude of the problem, develop a quantitative model, and determine the options (and tradeoffs) available within economic, political, and social constraints. In other words, the courses emphasize the engineer's approach and the role of technological fixes to ameliorate current problems.

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During the last few years, student interest has moved toward a deeper understanding of technology and engineering methods of problem-solving. In response, the College now offers courses on communications, space programs, weather modification, and techniques of problem-solving. In each case, the goal is to give the students substantive understanding which will be useful to them in their careers and lives, and which will introduce the basic concepts on which modern technology is built.

As one specific example, the problem-solving course uses decision trees as models for multi-stage decision processes. Within this context, the students develop the tree for the decision faced by the 35-year-old, prospective mother in deciding whether to have amniocentesis -- a decision complicated by the risks of the procedure, probabilities of false positives, lateness of the final decision if tests are positive, and so forth. The decision tree clarifies the structure of the entire problem and indicates the importance of the various probabilities involved to allow a more "informed" decision in this very personal matter.

These undergraduate offerings vary from moderately large, lecture classes for the basic courses to small classes (e.g., in technology assessment) and student project work. The courses are offered by the engineering college; students are encouraged to take related courses in philosophy, sociology, history, and English. The program does not follow the practice of some universities in offering courses taught by teams of faculty drawn across disciplines because the engineering faculty feels that a single course is most effective if it emphasizes one viewpoint and approach.

The educational program (for both undergraduates and graduates) also includes the establishment and operation of the Personal Computers Laboratory, where 20 computers are available for student use.

II. Undergraduate Engineering Students

The engineering college also has a responsibility to introduce engineering students to the social, economic, and political implications of the technology. For academic and advising reasons, the college has chosen to try to meet this objective in terms of four particular courses and infiltration of other engineering courses, rather than by a degree program in

societal engineering or engineering and society (a direction which has not always been successful at other universities).

The four courses are:

- Freshman engineering
- Biomedical engineering
- Engineering and managerial economics
- Communication skills in engineering and applied science

The first centers around engineering techniques in specific problems (e.g., development of the electric car) and the last involves the students in weekly writing assignments appropriate to engineering. In both cases, however, a "hidden agenda" is the development of student awareness of the social dimensions of engineering.

In the last course, for example, the students in the fall of 1979 wrote an analysis of the operating procedures of the Consumer Product Safety Commission -- an assignment designed to initiate consideration of the role of federal regulation and the impact of product liability considerations on technological innovation.

III. Graduate Students

The College offers a number of graduate courses designed for the non-engineering students and a master's degree (in applied science) for students seeking a total program in modern technology and engineering techniques of problem formulation and analysis. Over the last six years, the master's program has proven attractive to both secondary school teachers and individuals in technology-related professions.

In addition, college faculty participate in a program to develop technology courses for graduate students in public administration, offer workshops (and courses) on educational uses of computers, and have led the campus in experimentation with television delivery of graduate courses. In each case, these activities are a part of the broad commitment of the university to develop a better understanding of today's technological environment among the population of Long Island and New York State.

IV. General Public

The critical national challenge of public understanding of technology is currently being addressed through an enormous variety of activities; e.g., the new magazines (OMNI, Science 80, etc.), science and technology museums, and public and commercial television. Members of the college faculty are active in a variety of these undertakings -- for instance, in the work of the American Association for the Advancement of Science (AAAS), in the set of films (The Search for Solutions) developed by Playback Associates under a grant from Phillips Petroleum, in the development of teaching materials associated with the PBS Connections series, and in the development of educational programs for personal computers.

In addition, the college is publishing a series of monographs on specific socio-technological issues. Distributed to other colleges as well as to regional groups, the first three are on

Supermarket Automation -- Auto Safety -- Urban Fire

and are designed to stimulate public interest and awareness of current socio-technological problems.

V. Pre-College Students

The college has one of the most active groups nationally in the development of secondary school educational materials designed to present an understanding of modern technology. Under a five-year grant from the Alfred P. Sloan Foundation, the college's National Coordinating Center for Curriculum Development (NC³D) is developing educational modules for use in secondary school courses in English, math, and science. Typically two weeks of student work, these units complement and enrich regular course content. By early 1980, 600,000 student copies have been distributed, with the focus on schools with significant minority populations. For the introduction of these materials into high schools, the Stony Brook Center works with a nationwide set of engineering schools, often organized in regional consortia.

In an entirely separate activity directed to the local Long Island scene, the College has offered a Saturday-morning, college course on Man, Technology and Society for especially gifted high school juniors and seniors. With enrollment every year severely limited to about 140 as the largest manageable class, the course has been enthusiastically received by students, parents, and teachers as an important enrichment of the secondary school program for talented students.

THE DEPARTMENT OF TECHNOLOGY AND SOCIETY

Descriptive Data

Faculty

The Department faculty consists of six people with full-time involvement and three members who have partial commitments elsewhere in the engineering college and university:

Ludwig Braun,	Professor
Thomas T. Liao,	Associate Professor
E. Joseph Piel,	Professor and Chairman
Robert Seidman,	Assistant Professor
John G. Truxal,	Distinguished Teaching Professor
Dean Winter,	Assistant Professor
Arthur Gilmore,	Lecturer, also Executive Director, Center for Industrial Cooperation
Lester Paldy,	Associate Professor, also Dean for Continuing Education
Marian Visich, Jr.,	Professor, also Associate Dean of Engineering and Applied Sciences

Teaching Activities 1979-80

During the academic year, the faculty taught the following courses (with enrollment data given).

Undergraduate

EST 190	People, Technology and Society (introductory course for liberal arts students) 3 sections, total enrollment	478
EST 192	Introduction to Modern Engineering (freshman engineering)	102
EST 100	Societal Impact of Computers, 2 sections	174
EST 191	Introduction to Technology Assessment	15
EST 194	Patterns of Problem Solving	95
ESI 310	Biomedical Engineering	38
EST 310	Man in Space	50
EST 320	Cybernetics	180
EST 390	Communication Skills in Engineering and Applied Sciences, 2 sections	165
EST 392	Engineering and Managerial Economics, 2 sections	139
ESG 271	Electrical Sciences	120
ESG 261	Mechanics	165
ESG 318	Junior Engineering Laboratory (Independent Study)	20
Total Students		1732

Graduate

CEN 580	Socio-Technological Problems, enrollment	35
CEN 581	Decision-making	10
CEN 582	Systems Approach	11
CEN 583	Computer Literacy, 2 sections	95
CEN 585	Technology in Learning Systems	14
CEN 586	Automation	7
CEY 565	Personal Computers in Education	40
CEY 570	Design of Computer Courseware	17
CEN 591	Technology and Social Change (Connections Series)	69
ESE 584)		
ESE 585)	Project seminar and Independent Study	42
		<u>340</u>

These data yield a teaching commitment corresponding to a student/faculty ratio of 30.

Grant Support

During the last decade, the faculty of the Department have received external grant support averaging annual expenditures of approximately \$80,000 per faculty member. Major grants (over \$100,000) in the period have included:

NSF -- Engineering Concepts Curriculum Project -- total \$2M terminating early in the period -- for development of the Man-Made World, a high school course on modern engineering.

NSF -- Huntington Computer Project -- total \$1.2M terminating early in the period -- for development of computer simulations in science and social science.

NSF -- Technology, People, and Environment -- \$250,000 -- for development of secondary-school educational units.

NSF -- Socio-Technological Instruction Modules -- \$130,000 for college curricular units.

NIH -- Modeling of the Respiratory System -- \$200,000 ending early in the period.

Exxon Education Foundation -- Development of an engineering course for general students, \$100,000.

Alfred P. Sloan Foundation -- Educational technology, \$450,000.

Alfred P. Sloan Foundation -- National Coordinating Center for Curriculum Development, \$2.6M for minorities-in-engineering effort.

In addition, the Department has received support for a series of summer workshops, specific educational experiments and curricular developments in smaller grants from the National Science Foundation and Department of Energy, as well as support from LILCO, IBM, GM, AT&T, Westinghouse, Fairchild Republic and GE.

Professional activities of faculty

During the last three years, members of the faculty have served in the following professional and educational capacities directly related to the central thrust of the Department:

Federal government and related activities:

- | | |
|---|--|
| National Science Foundation | -- proposal-evaluation panelists, speaker at workshops for project directors, visiting team member for Resource Centers in Science and Engineering. |
| National Institute of Education | -- consultants for reports on personal computers in education and educational technology. |
| National Assessment of Educational Progress | -- math and science consultant for test development. |
| National Research Council | -- member, Panel on School Science
member, Committee on Transportation
member, Committee on Policy and Science and Engineering Education
member, Committee on Minorities-in-Engineering |

Professional societies:

- AAAS Chautauqua program lecturer
- AAAS Committee on Public Understanding of Science (chairperson)
- IEEE Committee on Public Understanding of Technology (past chairperson and member)
- NSTA Committee on Youth Activities, member - session organizer and speakers
- JETS Board member
- ASEE Speaker and committee participant

Other Colleges and Universities:

- CUTHA -Council on Understanding of Technology and Human Affairs, members and participants.
- Minorities-in-Engineering programs - cooperation with regional consortia in California, New Mexico, southeast, Texas, midwest, Philadelphia, New York, northeast.
- Syracuse - consultant on technology courses for public administration graduate schools.
- Colorado - Project Syntheses, chairman of Focus group on science, technology, and society.
- Human Sciences Project of BSCS, member of steering committee.
- CREST, member of steering committee.

Northeast Regional Educational Television Network - adviser.

Work with individual colleges and universities (Berkeley Lawrence Hall of Science, Farmingdal A & T College, Iona College, Union College of Cranford, N. J., University of Hartford, Pratt, etc.).

Minnesota Educational Computing Consortium - consultant.

Industrial relations:

McGraw-Hill, Wiley, World Book

Consultants for IBM, Commodore, Atari, JN Company, ATT (Connections programs), Playback Associates on "The Search for Solutions" films.